REMARKS

This Amendment is in response to the Office Action mailed October 12, 2004. In the Office Action, (i) claims 1-19, 15-19, 22-41 were rejected under 35 U.S.C. § 103(a); (ii) claims 13-14 were allowable but objected for being dependent; and (iii) claims 20-21 were allowed. Reexamination and reconsideration in view of the amendments and the remarks made herein is respectfully requested.

Applicant has amended claims 1-4, 6-7, 10, 12-13, 17-19, 27, 33, and 37 as by this response. Applicant has added new dependent claims 42-60. Claim 11 has been cancelled without prejudice. Accordingly, claims 1-10 and 12-60 are now pending. Of those pending, claims 1, 10, 13, 19, and 20 are independent claims.

Applicant believes that no new matter has been added by this response

I) ALLOWED CLAIMS

In section 38 of the Office Action, claims 20-21 are indicated as being allowed. Applicant respectfully thanks the Examiner for such indication.

II) CLAIM OBJECTIONS - DEPENDENCY

In section 37 of the Office Action, claims 13-14 were indicated as being allowable but objected for being dependent upon a rejected base claim. The Office Action indicated therein that the claims would be allowable if rewritten into independent

form including all the limitations of the base claim and any intervening claims. [Office Action, page 20]

Applicant has amended claim 13 into independent form including limitations from the rejected base claim, independent claim 10. There is no intervening claim. Dependent claim 14 now directly depends from an independent claim, claim 13.

Applicant believes the amendment to claim 13 places claims 13-14 in condition for allowance such that this objection is now moot. Applicant respectfully requests the withdrawal of this objection to claims 13-14.

III) Claim Rejections Under 35 U.S.C. § 103(a)

In section 5 of the Office Action, claims 1-9 and 22-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,216,235 issued to Thomas, et al. ("Thomas") in view of U.S. Patent 5,822,596 issued to Casal, et al. ("Casal"). [Office Action, page 2]. Applicant respectfully traverses this rejection.

In section 16 of the Office Action, claims 10-12, 15-17, and 27-33 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thomas in view of U.S. Pat. No. 5,719,800 issued to Mittal et al. ("Mittal"). [Office Action, page 7]. Applicant respectfully traverses this rejection.

In section 25 of the Office Action, claims 18 and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thomas in view of Casal and Mittal. [Office Action, page 11]. Applicant respectfully traverses this rejection.

In section 28 of the Office Action, claims 19, 35, and 37-41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thomas in view of U.S. Pat. No. 5,451,892 issued to Joseph

A. Bailey ("Bailey"). [Office Action, page 14, (see section 30 regarding claim 35 inclusion)]. Applicant respectfully traverses this rejection.

In section 32 of the Office Action, claim 36 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Thomas in view of Bailey and Casal. [Office Action, page 16]. Applicant respectfully traverses this rejection.

The Office Action seems to confuse the measuring of a temperature of an integrated circuit by means of a temperature sensor with generating a measure of global functional activity in an integrated circuit.

Applicant has amended independent claims 1, 10, and 19 to clarify the claimed invention in order to overcome this confusion.

Applicant has amended independent claim 1 to further recite "receiving a plurality of localized measures of activity in an integrated circuit" and that the generation of the measure of global functional activity is "responsive to the plurality of localized measures of activity" that are received. Applicant has further amended independent claim 1 to clarify that the predetermined limit is a predetermined limit of activity.

Applicant has amended independent claim 10 to further recite that the activity detector "receive[s] a plurality of localized measures of activity of functional blocks in the integrated circuit" and that the measure of global functional activity of the integrated circuit is generated "responsive to the plurality of localized measures of activity". Applicant has further amended independent claim 10 to clarify that the predetermined limit is a predetermined limit of activity.

Applicant has amended independent claim 19 to further recite that the activity detector "receive[s] a plurality of measures of local functional activity respectively associated with a plurality of functional blocks of an integrated circuit" and that the total measure of functional activity of the integrated circuit is generated "responsive to the plurality of measures of local functional activity". Applicant has further amended independent claim 19 to clarify that the enable throttling signal is generated "responsive to a determination that the total measure of functional activity exceeds the predetermined limit of activity".

Applicant's total measure of functional activity or measure of global functional activity is not a temperature level that is measured by a temperature sensor. Applicant's measure of local functional activity is a number representing a magnitude of the functional activity of circuitry in a functional block at a point in time, such as the number of logic gates (e.g., NAND, NOR, XOR, XNOR, INVERTOR) with outputs changing state therein, the number of nodes switching from one logical state to another therein, or a duty cycle of the functional block over a number of clock cycles, for example.

As discussed in Applicant's specification, "[t]he thermal activity detector 310 of the controlled clock generator 202 receives activity information from all of the functional blocks 205, 207, and 209 over activity information signal lines 311 to generate a total measure of functional activity for the integrated circuit 201." "[T]he activity detector 310 monitors the magnitude of the activity of each functional block and adjusts or appropriately weights the level of functional activity of each functional block in order to obtain a measure

of global activity to estimate the power consumption and heat generated in the entire integrated circuit. The thermal activity detector 310 determines whether or not the measure of total activity of the integrated circuit meets or exceeds a predetermined limit of activity (referred to as a "thermal limit") where it is desirable to reduce the heat generated by the activity in the integrated circuit to achieve a safe temperature level." [Specification, page 8, lines 22-26 and page 8, line 32 through page 9, line 10].

"During patent examination, the pending claims must be "given *their broadest reasonable interpretation consistent with the specification." [MPEP § 2111, 8th Ed. Rev 2, May 2004, page 2100-46 citing *In re Hyatt*, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000).] "[D]uring examination the USPTO must give claims their broadest reasonable interpretation. This means that the words of the claim must be given their plain meaning unless applicant has provided a clear definition in the specification." [MPEP § 2111, 8th Ed. Rev 2, May 2004, page 2100-47 citing *In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989)]

To construe levels of functional activity as a temperature level improperly ignores the ordinary meaning of the terms found in the claims and is inconsistent with the meaning of the terms found in the written description of Applicant's disclosure.

Applicant respectfully submits that the combination of Thomas and Casal does not disclose "receiving a plurality of localized measures of activity in an integrated circuit"; "generating a measure of global functional activity in an integrated circuit responsive to the plurality of localized measures of activity"; and "determining if a predetermined limit of activity has been met or exceeded by the measure of global

functional activity in the integrated circuit" as recited in amended independent claim 1.

The Office Action cites Thomas's Col. 3, lines 45-51 in support of the statement "temperature is a measure of functional activity". However, no support can be found there for this conclusion.

Thomas's temperature sensor 4 does not generate a measure of functional activity of circuitry, such as a number representing the number of gates changing state or the number of nodes switching from one logical state to another, for example. In contrast, Thomas's "temperature sensor 4 produces a temperature signal 6." [Thomas, Col. 3, lines 41-51].

Additionally, Thomas's temperature sensor 4 does not receive a plurality of localized measures of activity in the integrated circuit. Moreover, Thomas's temperature sensor 4 and temperature signal 6 are not responsive to a plurality of localized measures of activity in the integrated circuit. Thomas only discloses that Thomas's "temperature sensor 4 is []responsive to the ***temperature changes of the microprocessor*** 2". (emphasis added) [Thomas, Col. 3, lines 47-49].

The Office Action seems to use impermissible hindsight relying on Applicant's specification when it states "As is recognized by those of ordinary skill the temperature is a measure of global functional activity. Specifically, temperature is proportional to the activity of an integrated circuit." [Office Action, page 17, section 34, lines 6-8].

"Temperature, a measure of heat, is proportional to power consumption" as is discussed in Applicant's background section. [Specification, page 1, lines 17-18]. Into a capacitive load, the average power consumption is proportional to the operational frequency of the clock, the capacitive load, and the voltage

swing through the equation $P = 1/2\ C\ V^2\ F$. Thus, if a circuit with a capacitive load is constantly clocked, the "heat generated by electronic circuitry is a direct function of clock frequency" as is discussed in Applicant's background section. [Specification, page 1, lines 15-17].

However, circuitry in an integrated circuit is not always clocked. Circuitry in an integrated circuit may change state infrequently on occasion. Additionally, capacitive loads differ so that power consumption and heat generation will further differ from circuit to circuit.

Moreover, a simple temperature sensor doesn't accurately determine a measure of local functional activity of a circuit or accurately determine a measure of global functional activity. Actual temperature sensors are never ideal - having measurement errors or deviations from ideal transfer functions. Sensors often have non-linear errors, calibration errors, hysteresis errors, saturation errors, dead bands, or repeatability errors. [See Handbook of Modern Sensors, 2nd Edition, by Jacob Fraden, Copyright 1996, Pages 13-19, provided in an IDS submitted herewith]. Additionally, a temperature sensor introduces error when making contact and transferring heat away from an object being measured. Moreover, heat at a temperature sensor is lost to the environment through any connecting and supporting structure introducing further error in a temperature measurement. [See Handbook of Modern Sensors, 2nd Edition, by Jacob Fraden, Copyright 1996, Pages 458-459, provided in an IDS submitted herewith]

The Office Action states that "Applicant['s] state[ment] that the temperature sensor is either within the housing or in contact with the housing or package thereof, which further shows that the temperature is a measure of global functional

activity". [Office Action, page 18, lines 3-5]. Applicant respectfully disagrees with this jump to conclusion in the Office Action as it is fallacious. This remark only shows that the temperature sensor is a contact type sensor and not a non-contact type sensor, such as a thermal detector. [See Handbook of Modern Sensors, 2nd Edition, by Jacob Fraden, Copyright 1996, Pages 414-429 and 458-459, provided in an IDS submitted herewith]

Moreover, Thomas does not disclose "determining if a predetermined limit of activity has been met or exceeded". In contrast, Thomas discloses temperature regulation. Thomas's "fast clock is [a clock signal having a] ***temperature regulated maximum frequency***". (emphasis added) [Thomas, Col. 4, lines 62-64]. Thomas's discloses using "some threshold temperature (V_{TH}) (e.g., 120 degrees F)" to regulate the maximum frequency. [Thomas, col. 4, lines 9-10].

Nor does Casal disclose "receiving a plurality of localized measures of activity in an integrated circuit", "generating a measure of global functional activity in the integrated circuit", and "determining if a predetermined limit of activity has been met or exceeded" as recited in amended independent claim 1. This is because Casal is triggered upon a system power up or a system power down ***without concern of the functional activity*** of the functional blocks within an integrated circuit. (emphasis added)

Thus, Applicant respectfully submits that Thomas and Casal, alone or in combination, do not make obvious Applicant's claimed invention of independent claim 1.

Dependent claims 2-9 and 22-26 depend directly or indirectly from independent claim 1. Applicant believes that it has placed claim 1 in condition for allowance such that claims 2-9 and 22-26 depending there from with additional limitations are also in condition for allowance.

Regarding independent claim 10, Applicant respectfully submits that the combination of Thomas does not disclose "an activity detector to receive localized measures of activity of functional blocks in the integrated circuit and generate a measure of global functional activity of the integrated circuit responsive to the localized measures of activity".

The prior comments with respect to Thomas and independent claim 1 are incorporate here by reference. As discussed previously, Thomas's temperature sensor 4 does not generate a measure of activity of circuitry such as the number of gates changing state or the number of nodes switching from one logical state to another, for example. In contrast, Thomas's temperature sensor 4 produces a temperature signal 6." [Thomas, Col. 3, lines 41-51].

Moreover, Thomas's temperature sensor 4 does not receive a plurality of localized measures of activity in the integrated circuit. Thomas's temperature sensor 4 and temperature signal 6 are not responsive to the plurality of localized measures of activity in the integrated circuit. In contrast, Thomas discloses that Thomas's "temperature sensor 4 is []responsive to the temperature changes of the microprocessor 2". [Thomas, Col. 3, lines 47-49].

Additionally, Thomas's activity detector 12 does not measure global functional activity of an integrated circuit. Thomas's activity detector 12 only monitors a system to provide

an indication as to whether or not Thomas's microprocessor 2 has some processing to do or not, so that it can be put to sleep. If Thomas's activity detector 12 determines there is some processing to perform, "the activity detector 12 notifies the VCO controller 16 that processing is needed with the activity signal 14. On the other hand, when no activity exists, the activity detector 12 notifies the VCO controller 16 that no processing is needed with the activity signal 14." [Thomas, Col. 4, lines 35-39]. "[I]f the activity detector 12 indicates that no processing is needed at a given point in time, then regardless of the temperature detected by the temperature sensor 4, the VCO controller 16 will cause the VCO 8 to produce a sleep (or slow) clock." [Thomas, Col. 4, lines 54-58].

Thomas's activity detector 12 does not receive levels of activity from functional blocks of the integrated circuit to be capable of measuring the global functional activity therein. Thomas's activity detector 12 externally "monitors the microprocessor 2 and/or some related peripheral device (e.g., interrupt controller, keyboard buffer, input/output ports, instruction cache, current instruction, program counter)" as is illustrated in Figure 3. Even if integrated with the microprocessor, Thomas's "activity detector 48 [functions] similarly to the activity detector 12" and receives external types of activity inputs such as "an interrupt, keyboard activity, modem line activity, I/O port activity, or processor activity" to indicate whether or not the type of activity exists at all. [Thomas, Col. 6, lines 53-55, 57-61]. That is, Thomas's activity detectors do not receive levels of activity from functional blocks of an integrated circuit. Moreover, the output from Thomas's activity detectors, "the activity signal is a digital signal which is "high" or "1", when activity is

present and "low" or "0" when no activity is present." [Thomas, Col. 5, lines 58-60]. Thomas's activity signal indicates when no activity is present and does not provide a measure of global functional activity within an integrated circuit.

Thus, Applicant respectfully submits that Thomas does not disclose "an activity detector to receive a plurality of localized measures of activity of functional blocks in the integrated circuit and generate a measure of global functional activity of the integrated circuit responsive to the plurality of localized measures of activity" as recited in independent claim 10. [Claim 10, lines 3-4].

Additionally, the Office Action alleges that Thomas's oscillator 8 discloses Applicant's clock throttling controller to which Applicant respectfully disagrees. Thomas's oscillator 8 ***is not responsive to global functional activity.*** Thomas's "VCO 8 operates to produce different frequencies of the clock signal 10 depending upon the value of the ***temperature signal.***" (emphasis added) [Thomas, Col. 3, lines 55-57]. Moreover, Thomas's oscillator 8 ***is not responsive to*** *the measure of global functional activity* ***meeting or exceeding*** a ***predetermined limit of activity*** as is recited in claim 10. [Thomas, Col. 5, lines 64-65].

Nor does Mittal disclose Applicant's clock throttling controller to generate a throttled clock and gradually throttle the frequency of the throttled clock in response to a measure of global functional activity meeting or exceeding a predetermined limit of activity.

Thus, Applicant respectfully submits that the combination of Thomas and Mittal does not disclose a "clock throttling controller to generate a throttled clock to couple to functional blocks of the integrated circuit for clocking circuitry therein,

the clock throttling controller to gradually throttle the frequency of the throttled clock to the functional blocks in response to the measure of the global functional activity meeting or exceeding a predetermined limit of activity" as recited in independent claim 10. [Claim 10, lines 13-17].

For the foregoing reasons, Applicant respectfully submits that combination of Thomas and Mittal does not make obvious Applicant's independent claim 10.

Regarding dependent claims 11-12, the Office Action alleges that "Mittal teaches using temperature as a measure of the activity of a plurality of functional blocks." Applicant respectfully disagrees.

At col. 5, lines 39-43 of Mittal cited for support by the Office Action, it states "if it is desired to monitor the overall power consumption of an IC, then its substrate temperature could be measured and this value used as the activity level of the invention." [Mittal, Col. 5, lines 39-43].

Mittal does not teach that substrate temperature and activity levels are equivalent. Mittal only suggest that one could substitute measuring substrate temperature instead of measuring activity levels if one desired to monitor the overall power consumption of an IC. Also, Mittal does not suggest that measuring substrate temperature will provide a measure of local functionality.

Applicant's claims recite measuring local activity levels and generating a measure of global functional activity. Applicant's claims do not recite temperature levels.

Moreover, dependent claims 11-12, 15-18, and 27-34 depend directly or indirectly from independent claim 10. Applicant believes that it has placed independent claim 10 in condition for allowance such that claims 11-12, 15-18, and 27-34 depending there from with additional limitations are also in condition for allowance.

Regarding independent claim 19, the Office Action alleges that Thomas teaches Applicant's activity detector (thermal sensor) and Applicant's clock throttling controller. Applicant respectfully disagrees.

As discussed previously with respect to independent claim 10, Thomas does not disclose Applicant's claimed activity detector and does not disclose Applicant's claimed clock throttling controller. The detailed remarks with respect to independent claim 10 are incorporated here by reference.

Applicant's claims 19 recites receiving a plurality of measures of local functional activity and generating a total measure of functional activity responsive thereto. Applicant's claim 19 does not recite temperature levels. A temperature level is not a measure of functional activity in Applicant's claimed invention.

Thus, Thomas does not disclose Applicant's activity detector as recited in claim 19.

Nor does Bailey disclose Applicant's claimed activity detector. Bailey only discloses a "Thermal sensor 134 is a thermal sensing circuit that generates an output signal indicative of temperature." [Col. 4, lines 57-58]. Bailey does not teach detecting the overall activity of the integrated circuit.

Regarding Applicant's clock throttling controller, while citing Thomas at Col. 4, lines 9-11, the Office Action failed to point to any equivalent structure in Thomas as Applicant's clock throttling controller. Instead, the Office Action seems to rely on Bailey. Thus, the Office Action has not shown that Thomas discloses Applicant's clock throttling controller recited in claim 19.

The Office Action admits that Thomas does not expressly show a free-running clock generator to generate a free-running clock or a free-running clock generator coupled to an activity detector and a clock throttling controller. Instead the Office Action relies on Bailey.

The Office Action alleges that "Bailey teaches a clock generator comprising a free-running clock to generate a free running clock generator (external clock) to generate a free running clock and that the free running clock is coupled to an activity detector (thermal sensor 134 - detecting the overall activity and server integrated circuit) and clock throttling controller (clock management unit along with the PLL 122 and circuit divider)."

However, there is no structure of a free-running clock generator shown or described in Bailey. Applicant has searched Bailey for a reference to free-running clock and can find none. There is little description of Bailey's external clock signal to jump to the conclusion that it is a free running clock generated by a free-running clock generator. Bailey states "The clock control circuit 101 receives an external clock signal at a line 110 and provides a timing signal to clock generator and distribution unit at line 112." [Bailey, Col. 4, lines 27-30]. Bailey further states "Phase locked loop circuit 122 receives

the external clock signal at line 110 and synthesizes an output signal at line 158." [Bailey, Col. 5, lines 6-8].

Thus, it is respectfully submitted that neither Thomas nor Bailey disclose a free-running clock generator.

For the foregoing reasons, Applicant respectfully submits that combination of Thomas and Bailey does not make obvious Applicant's independent claim 10.

Dependent claims 35-41 depend directly or indirectly from independent claim 19. Applicant believes that it has placed independent claim 19 in condition for allowance such that claims 35-41 depending there from with additional limitations are also in condition for allowance.

In conclusion, Applicant respectfully requests the withdrawal of all of the 35 USC 103(a) claim rejections of claims 1-12, 15-19, and 22-41 for the foregoing reasons.

IV) NEW CLAIMS

Applicant has added new dependent claims 42-60.

New claims 42-44, 45-47, 48-55, 56-58, and 59-60 respectively depend directly or indirectly from independent claims 1, 10, 13, 19, and 20.

Applicant believes that it has placed independent claims 1, 10, 13, 19, and 20 in condition for allowance such that dependent claims depending there from with further limitations are also in condition for allowance. Applicant respectfully submits that new dependent claims 42-60 are also in condition for allowance.

V) CLAIM AMENDMENTS

Applicant has amended claims 1-4, 6-7, 10, 12-13, 17-19, 27, 33, and 37.

The basic limitations of claim 11 were added into claim 10. Thus, claim 11 was cancelled without prejudice.

As discussed previously, claim 13 was amended into independent form including the limitations of the base claim 10 to overcome a claim objection.

As discussed previously independent claims 1, 10 and 19 were amended to clarify that the invention is directed to measures of activity in an integrated circuit and not temperature levels - unrelated to reasons of patentability. Claims 1 and 10 were amended to further clarify that a predetermined limit of activity is recited - unrelated to reasons of patentability. Dependent claims 2, 7, 12, 17-18 27, 33, and 37 were amended accordingly to clarify the predetermined limit of activity being recited - unrelated to reasons of patentability.

CONCLUSION

In view of the foregoing it is respectfully submitted that the pending claims are in condition for allowance.

Reconsideration of the rejections and objections is requested. Allowance of the claims at an early date is solicited.

The Examiner is invited to contact Applicant's undersigned counsel by telephone at (714) 557-3800 to expedite the prosecution of this case should there be any unresolved matters remaining.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees in connection with the filing of this paper, including extension of time fees, to Deposit Account 02-2666 and please credit any excess fees to such deposit account.

Respectfully submitted,
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: April 12, 2005

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450 *on:* April 12, 2005.

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